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ABSTRACT

In 1990, a statewide study was conducted to examine issues which affected the teaching of science in Florida's community colleges and to make recommendations for improvement. The study involved reviews of the literature and existing data, the selection of an advisory committee and committee meetings, site hearings, and the creation and distribution of a survey. The study focused on the following issues: (1) the preparedness of entering freshmen; (2) the performance of community college science majors at the junior and senior levels; (3) the nature of the science experience for nonscience majors; (4) the acceptance of community college science credit toward the baccalaureate; (5) the quality of academic advising for community college science majors; (6) opportunities for improving the knowledge and skills of community college science faculty; (7) the degree to which there were professional exchanges between community college faculty and their counterparts in high schools and universities; (8) efforts to increase the number of minority science faculty; (9) problems associated with the supervision of part-time science faculty; and (10) the need for updated scientific instructional equipment. Based on study findings, 12 recommendations were made, focusing on ways to improve articulation, curriculum, instruction, faculty, and equipment and facilities. Appendixes provide the survey instrument and a listing of attendance at site hearings. (JMC)

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ED317249

A Comprehensive Review of Science Instruction in Community Colleges

By
State Board of Community Colleges

JC 900201

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April 6, 1990

PREFACE

The review of instructional programs in community colleges is a multi-level process, involving institutional personnel, students, Department of Education personnel, affected state agencies and organizations, and the Division of Universities. This review was a statewide, issue-oriented review, primarily to discover needs for state policy and other changes that will result in improving the understanding of science by students enrolled in the associate in arts degree programs in Florida's public community colleges.

Credit for this review is due in part to the fine work of the Science Review Advisory Committee. The Committee organized and conducted the site hearings that provided forums for discussion of the issues by their community college colleagues, science teachers from the high schools, public school science supervisors, representives from the state universities, and interested community college administrators. In addition to conducting the site hearings and writing the findings of the hearings, the Committee met to discuss the findings and to talk about the implications of the findings for science instruction in the community colleges. Most of

the recommendations herein were proposed by the Committee.

The members of the Science Review Advisory Committee for the review of the science component of the associate in arts degree were:

Dr. Jane MacDonald, Miami-Dade Community College
Dr. Jeanne Robinson, Seminole Community College
Dr. Anita Harrow, Valencia Community College
Dr. Tom King, St. Petersburg Junior College
Ms. Elizabeth Gibson, St. Johns River Community College
Dr. Edwin Stout, Pensacola Junior College
Dr. Ronald Head, Okaloosa-Walton Community College
Dr. Robert Wall, Lake-Sumter Community College
Ms. Ann Springer, Hillsborough Community College
Dr. Carolyn Girardeau, Florida Community College at Jacksonville
Mr. Gabriel Milanese, Broward Community College
Mr. Allan Bonamy, Daytona Beach Community College
Dr. Martha Green, Division of Public Schools, Florida Department of Education
Dr. Pat Hayward, Florida State University

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PURPOSE

The purposes of this statewide program review of science instruction in the community colleges were to examine issues that bear upon the teaching of science in Florida's community colleges and to make recommendations to improve the teaching of science in the community colleges. The issues examined were:

1. The degree to which entering freshmen have the skills necessary to profit from college level science courses.
2. The degree to which community college science majors are able to compete at the junior and senior level with science majors who take their freshmen and sophomore work in the State University System.
3. The nature of the science experience for community college students who do not plan to major in science at the junior and senior level.
4. The status of the transfer of community college science credit into the State University System for those majoring in a science discipline.
5. The accuracy and timeliness of academic advising for students who plan to transfer to the State University System as science majors.

6. The opportunities for community college science faculty to stay abreast of changes in their disciplines.

7. The degree to which there are professional exchanges of information between community college faculty members and their colleagues in the State University System and in the public schools.

8. The distribution of minority faculty in community college science disciplines and the efforts to increase minority representation on community college science faculties.

9. The supervision of part-time science faculty.

10. Equipment needs.

PROCESS

The process by which the review of the science component of the associate in arts degree was conducted contained six basic elements: review of the literature, review of specific print materials, review of appropriate existing data, selection of an advisory committee and advisory committee meetings, site hearings, and creation and distribution of a survey to obtain information about community college science instruction that is not available from other sources.

After the hearings were conducted and after the survey returns were received, questions remained about equipment needs and about the performance of community college associate in arts degree graduates in State University System upper division science programs. The services of a science education graduate student were used to help with additional study of these questions.

Print Material

1. "Biological Science Program Review." Report of Consultants to the Florida Board of Regents, March, 1987.

2. Brown, Shirley Vining. "Increasing Minority Faculty: An Elusive Goal." Report of the Minority Graduate Education Project, Educational Testing Service, 1988.

3. "Critical Issues in Two Year College Chemistry."

Report of the 1985 Invitational Education Conference of the American Chemical Society, November, 1985.

4. Florida Community College Catalogs.

5. "Guidelines for Chemistry and Chemical Technology Programs in Two Year Colleges." American Chemical Society, 1988.

6. "Higher Education Project Grants to Strength Programs in Mathematics, Science, and Computer Learning." Florida Department of Education, 1988.

7. "Improving Mathematics, Science, and Computer Education in Florida: A Comprehensive Plan." Florida Department of Education, April, 1989.

8. "Minority Graduate Education." Research Profiles, Number 2, Fall, 1987.

9. "Panel Urges Colleges to Boost Production of Minority Scientists." Chronicle of Higher Education, June 15, 1988.

10. "Science Achievement in Seventeen Countries." International Association for the Evaluation of Educational Achievement, Pergamon Press, 1988.

11. Yager, Robert E. "Assess All Five Domains of Science." The Science Teacher, October, 1987.

Existing Data

The Level I associate in arts and associate in science program review information compared the State University System (SUS) upper division performance of community college transfer students in science with the upper division performance of SUS native students in science. College preparatory testing results indicated the extent to which entering community college freshmen were prepared to profit from instruction in mathematics

as a foundation for the sciences.

Advisory Committee

A letter describing the nature of the review of the science component of the associate in arts degree was sent to the presidents of the community colleges. Each president was invited to nominate a dean, a science chairperson, and a science faculty member to serve on a committee that would guide the development of the program review. Committee members were selected based on college location and size, and to achieve a representative distribution of administrators, science division chairpersons, and teaching faculty.

Three meetings of the Advisory Committee were held. The first meeting was an orientation meeting where the purpose of the review was discussed and the process described. The second meeting was to discuss what was heard at site hearings held throughout the state to discuss issues involving the teaching of science in the community colleges. The third meeting was to make recommendations based on the issues that were discussed.

Site Hearings

Five site hearings were held. The locations were chosen to allow representatives from all the community colleges, state universities, and public schools to attend. The locations were Pensacola, Jacksonville,

Orlando, Fort Lauderdale, and St. Petersburg. Prior to each hearing, the colleges in the area of the hearing were notified and asked to send science faculty and science administrators to the meetings. Similar notices were given to the superintendents of schools and to the universities. A list of those who attended the hearings is in Appendix 1.

At least three members of the Advisory Committee attended each of the site hearings. Each of the issues identified in the chapter on purpose was discussed at each site hearing. Immediately following each hearing, the Advisory Committee members who were present wrote their impressions of what was brought out in the discussions, and sent the report to the Division of Community Colleges.

The Science Survey

After being briefed on the information that was available from the Division of Community Colleges and the Division of Universities, the Advisory Committee felt that there was a need for additional information. A survey was developed to obtain demographic information concerning the science faculty, knowledge of the relationship of the community college faculties to their colleagues in the universities and high schools, knowledge of the professional growth opportunities for

the science faculties, and anecdotal information about the performance of science students in the community colleges. The survey was sent to all twenty-eight colleges and responses were received from all twenty-eight colleges. A copy of the survey form is in Appendix 2.

FINDINGS

Preparation of Secondary Students for Community College Science Courses

Since the shock of the Soviet launching of Sputnik in 1957, Americans have realized that American public schools are not preparing students adequately in math and science. The International Association for the Evaluation of Educational Achievement (I.E.A.) conducted a 1970 study of achievement in science in nineteen countries. The study was repeated in the mid-1980's. At the 12th grade level, the tests were given by discipline: biology, chemistry, and physics. Thirteen countries participated. The United States ranked 13th in biology, 11th in chemistry, and 9th in physics.

In the executive summary of the publication describing the test results, Science Achievement in Seventeen Countries, the I.E.A. described the United States results:

> The achievement of advanced science students in biology, chemistry, physics is low. The biology results are especially low. For a technologically advanced country, it would appear that a reexamination of how science is presented and studied is required.

The need to improve science instruction and learning in Florida public schools is well recognized and

documented. A joint task force effort of the Florida Chamber of Commerce, the Florida Education and Industry Coalition, and the Department of Education involved twenty-eight business people and educators in fifteen months of study and deliberation. The result is an extensive report of the severity of the need and over one hundred recommendations for improving science, mathematics, and computer education. The report, "Improving Mathematics, Science, and Computer Education in Florida," contains the following findings about student achievement. It asserts that the achievement of Florida public school students generally is about the national average. Findings in mathematics are included, because mathematics is such an integral part of science.

The report refers to a 1989 National Research Council finding that United States students do not have the mathematical tools to sustain current technological growth, and that they are far behind other students in mathematical achievement. The Educational Testing Service reported a 1988 international study that found that 78% of Korean students showed proficiency at solving two-step mathematics problems that only 40% of the United States students could solve.

Florida students dropped two points on SAT mathematics between 1987 and 1988 to eight points lower than the national average. The Second International

Science Study revealed that Florida students compared with students from other countries scored below the twenty-fifth percentile in geometry, measurement, and advanced mathematics topics.

The 1987 State Student Assessment Test showed that 26% of Florida's fifth graders could not solve a purchase problem involving making change from $1.00. And, 23% could not tell how much time had elapsed between two events in terms of days, months, or years.

The Second International Science Study found that at grade five, the United States ranked in the middle in science achievement relative to fourteen other participating countries. At grade nine, the United States ranked next to last. In the upper grades, the United States advanced science students ranked last in biology and near last in chemistry and physics.

A common finding in studies of academic achievement is that United States students start school with knowledge about the same as in other countries, but that as they progress through school, they fall further behind students in other countries. United States students tend to learn some of the basic skills, but they do poorly on higher order skills that involve inference, logic, and reasoning.

The National Assessment of Educational Progress found that most United States thirteen-year-olds are

"poorly equipped for informed citizenship and productive performance in the work place, let alone postsecondary studies in science." The Assessment found that 47% of the thirteen-year-olds are not prepared for high school science and cannot apply basic scientific information. The Assessment found that only 7% of United States students have sufficient preparation to succeed in college-level science courses.

These findings about student achievement prompted the joint task force of the Florida Chamber of Commerce, the Florida Education and Industry Coalition, and the Department of Education to develop a plan for the improvement of mathematics, science, and computer education in Florida public schools. The plan contains over one hundred recommendations mentioned earlier in this section. After a briefing and deliberations on the plan, the State Board of Community Colleges wholeheartedly endorsed the plan.

Further, the State Board of Community Colleges has been working to strengthen the role of the community colleges in teacher education. That role encompasses recruitment and preservice and inservice education of teachers. Community colleges, therefore, are involved in the improvement of science education in the public schools through their role in science teacher education.

One of the many ways the community colleges address

the inservice portion of their role in science teacher education is through education and training projects funded under Title II of the Dwight D. Eisenhower Mathematics and Science Education Act. For 1989-90, twenty-two community colleges submitted proposals. Ten were awarded grants for a total of $570,199.

The American College Testing Program (ACT) is given in the junior year of high school. Of the Florida high school students who took the ACT in 1987, 63% scored at or above fourteen on the reading portion, which is the minimum to avoid remedial reading instruction in the community colleges. Seventy-five percent scored at or above the minimum math score of thirteen and 81% scored at or above the minimum writing score of fourteen. However, of the students who presented ACT scores to the community colleges in 1987-88, 70% met the minimum score in reading, 58% met the minimum score in math, and 74% met the minimum score in writing. The community colleges appear to draw a disproportionate share of ACT test takers who score below the minimums required to avoid remedial instruction in math and writing.

Of the Florida high school students who took the Scholastic Aptitude Test (SAT) in 1987, 78% scored at or above 340 on the reading portion, which is the minimum to avoid remedial instruction in the community colleges. Seventy-two percent scored at or above the minimum math

score of 400 and 86% scored at or above the minimum writing score of thirty. Of the students who presented SAT scores to the community colleges in 1987-88, 81% met the minimum score in reading, 71% met the minimum score in math, and 88% met the minimum score in writing. Assuming the minimum scores are comparable, the disproportion in the case of ACT test takers is not found in the case of SAT test takers.

TABLE 1

College Preparatory Testing
Community Colleges
1988-89

Tests	Reading		Writing		Mathematics	
	At/Above Standard	Below Standard	At/Above Standard	Below Standard	At/Above Standard	Below Standard
SAT	7,492 84%	1,429 16%	7,325 90%	831 10%	6,514 74%	2,324 26%
ACT	7,920 70%	3,374 30%	8,357 75%	2,839 25%	6,482 57%	4,867 43%
MAPS	29,323 75%	9,595 25%	27,622 72%	10,983 28%	19,912 51%	19,168 49%
ASSET	7,091 76%	2,271 24%	6,502 70%	2,801 30%	2,392 28%	6,214 72%
Total	51,826 76%	16,669 24%	49,806 74%	17,454 26%	35,300 52%	32,573 48%

Table 1 displays the 1988-89 results of entry-level tests taken by community college degree-seeking students. It shows that 48% of the high school graduates

entering community colleges do not have a minimum level of math skills judged necessary for college entry. Without such skills, students are not able to perform adequately in freshman chemistry, physics, or any science course requiring a sound foundation in mathematics. Since 24% of the entering students cannot read at the minimum level judged necessary for college entry, it is doubtful that they have the necessary skills to read a college biology or geology textbook.

The public school system in Florida has embarked on a significant plan for improving math and science instruction and learning in the public schools. The Table 1 totals are graphic evidence of the need. The 1989 Legislature recognized the need for remedial instruction in the community colleges and earmarked $6,000,000 in the 1989-90 appropriation to improve college preparatory (remedial) instruction.

Baccalaureate science programs are very demanding in terms of prerequisites, time, and rigor. Preparation to become a college science major should begin at least as early as the middle school/junior high school years. So much of the learning is sequential, with one skill building into another and one concept building into another. The commitment of time is significant as time-on-task is extensive. The programs are highly cerebral. There is heavy reliance on a related

discipline that is equally demanding in the same fashion, mathematics. Helping students to understand these characteristics and to act accordingly is a difficult task for public school counselors and faculty.

Recommendation 1.-- Recommend the community colleges search out and grasp opportunities to be supporting partners of the public schools for the improvement of math and science teaching and learning in the public schools. One of the many elements in this important effort should be articulation meetings between high school and community college math and science faculty, especially concerning the math and science skills expected of beginning college students and the math and science skills demonstrated by beginning college students.

Performance of Community College Transfer Students as Science Majors in the SUS

In 1985, the State University System (SUS) conducted a program review of the physical sciences. The consultants were asked to study student transfer from the community colleges to the universities. The review report states:

> Our guess is that 10% or 15% had come that route; [community college transfers] most seemed reasonably well prepared and said they had no trouble with the transition. . . All in all we found very few students going into the sciences from the junior colleges and the quality of preparation varied considerably.

The guess of the consultants in incorrect. Community college associate degree transfer students account for 30 percent of the enrollment in SUS upper division science programs. The percentage for community college students who transfer without the degree is not

known, but such transfers account for 10 percent of the total SUS upper division enrollment.

Table 2 displays the performance of students who transferred into the SUS after obtaining an associate in arts (A.A.) degree from a Florida community college. Also displayed is the performance of students, referred to as native students, who began their postsecondary education in the SUS. The table shows community college A.A. transfer students and native students in their junior and senior years in the life and physical sciences.

TABLE 2

A.A. Transfer
Student Performance in SUS
Life and Physical Sciences
1988-89

	Unduplicated Upper Division Headcount		Mean Cumulative GPA		% at 3.0 or Above		% Below 2.0		% Suspended		% Graduated		Avg. Credits Attempted Per Term		Avg. Credits Of Graduates	
	CC	Natives	CC	Natives	CC	Natives	CC	Natives	CC	Natives	CC	Natives	CC	Natives	CC	Natives
Life Sci.	731	868	2.62	2.93	27.2	51.8	16.1	2.1	3.9	1.2	16.6	24.8	8.9	10.8	145.8	135.7
Phys. Sci.	340	327	2.64	2.87	32.9	45.2	16.1	4.5	4.7	2.4	17.0	25.3	8.0	9.5	141.5	137.8
All Prog.			2.72	2.80	36.1	37.4	10.7	2.1	3.0	0.8	20.3	25.6	8.9	10.8	138.1	133.4

The A.A. transfer students' grade point averages are .31 and .23 below native students. There are fewer community college A.A. transfer students performing at

the 3.0 and above level than native students and more performing below the 2.0 level in both disciplines.

In the life sciences, 27.2% of the A.A. transfer students earn grade point averages (G.P.A.) of 3.0 or above compared with 51.8% of the native students. In the physical sciences, 32.9% of the A.A. transfer students earn G.P.A.'s of 3.0 or above compared with 45.2% of the native students. A difference also exists when A.A. transfers are compared with natives in terms of students earning G.P.A.'s below 2.0. Community college A.A. transfer students in the life sciences are below 2.0 in 16.1% of the cases and in the physical sciences in 16.1% of the cases. The native students perform below the 2.0 level in 2.1% of the cases in the life sciences and in 4.5% of the cases in the physical sciences.

In the life sciences, 3.9% of the A.A. transfers were suspended and 1.2% of the native students were suspended. In the physical sciences, 4.7% of the A.A. transfers were suspended and 2.4% of the native students were suspended.

The differences in performance are continued in the graduation rates, with A.A. transfers graduating at rates that are 8.2 percentage points lower than the rate for natives in the life sciences and 8.3 percentage points lower in the physical sciences. With respect to average course loads, A.A. transfers average a 1.9 credit lighter load each term than natives in the life sciences and a

1.5 credit lighter load each term in the physical sciences. With respect to credits earned for graduation, A.A. transfers average 10.1 credits more than natives in the life sciences and 3.7 credits more in the physical sciences. The range of average credits earned for graduation is 135.7 - 145.8, which equates to at least nine semesters.

These differences in the SUS upper division performance of community college A.A. transfer students and SUS native students are consistent with their 1985-86, 1986-87, and 1987-88 performance. These differences are consistent across the several comparison measures. These differences are of sufficient magnitude to capture attention.

These differences demonstrate better performance by SUS native students. What is there about the preparation of community college students for transfer into SUS upper division programs in the life sciences and the physical sciences to account for these differences? Transfer "shock" and the different methods of calculating G.P.A. for the two types of students may account for part of the differences, but how can the preparation of community college students who plan to become science majors be strengthened?

To try to answer these questions, the plan for the conduct of the review was altered and additional

resources were committed. Tallahassee Community College, Florida State University, and Florida A and M University students and faculty were interviewed. Florida State University native students, transfer students from Florida community colleges, and other transfer students were invited to respond in writing to a short list of questions comparing community college student preparation with university native student preparation. The annual Level I program review data displays were studied further. The findings and actions reported by the community colleges that resulted from the Level II program review articulation meetings were studied further. An unsuccessful effort was made to use the college transcript information gathered by the Postsecondary Education Planning Commission for its recent general education study to compare science program prerequisites taken by A.A. transfer students and by native students. Constraints on extending the time for the program review and on resources kept these efforts from being rigidly structured and controlled, and from being carried further at the time.

The interviews and written responses to questions did not provide a definitive answer to the question of what might account for the differences in the performance of community college A.A. transfer students and SUS native students in upper division science programs. They

did provide opinions on aspects of the question which, when expressed by the very students under consideration, must be considered seriously. Three out of every four community college A.A. transfer students who were questioned said the university demanded more academically. A science faculty member expressed a variation of that opinion by saying that the difference in the average ability of students in a limited access environment and of students in an open access environment forces a difference in the level of instruction. Another faculty member observed that community college students must compress all their general education courses into the first two years, which gives them less opportunity for science courses and limits their ability to intersperse the very demanding science courses with general education courses that have a different sort of demand. The written responses of the students to the question of what advice would you give to those coming up included: prepare to work harder and receive less attention, and pay careful attention to prerequisites.

Baccalaureate science programs characteristically are highly structured, prescriptive, sequential, and are built upon years of sequential mathematics and science prerequisites. These points are elaborated upon earlier in this report. Community college students tend to have had their academic endeavors interrupted, to choose their

academic programs late, and to be part-time students with other responsibilities competing for their time and effort. Students who are late in selecting academic programs that have extensive prerequisites are at a disadvantage. Recognizing that memory falls off rapidly with time, part-time students who select academic programs that require sequential learning are at a disadvantage. It is tempting to postulate that the incompatibility of the characteristics of upper division science programs and the characteristics of many community college students is at the root of the differences in the performance of community college A.A. transfer students and SUS native students. The following recommendation accepts that as an hypothesis.

Recommendation 2.-- Recommend a thorough study of the high school, community college, and university transcripts of community college associate in arts degree graduates and State University System native students enrolled in life science and physical science upper division programs in the SUS to compare the mathematics and science courses in their backgrounds and to compare upper division performance.

A few associate in science degree (A.S.) graduates from Florida community colleges enroll in SUS life science and physical science upper division programs. Table 3 compares their performance with the performance of A.A. transfer students in the same manner as the A.A./Natives comparison in Table 2.

TABLE 3

Student Performance in SUS
Life and Physical Sciences
A.A./A.S. Comparison
1988-89

	Unduplicated Upper Division Headcount		Mean Cumulative GPA		% at 3.0 or Above		% Below 2.0		% Suspended		% Graduated		Avg. Credits Attempted Per Term		Avg. Credits Of Graduates	
	AA	AS	AA	AS	AA	AS	AA	AS	AA	AS	AA	AS	AA	AS	AA	AS
Life Sci.	731	22	2.62	2.91	27.2	40.9	16.1	13.6	3.9	9.0	16.6	13.6	8.9	9.6	145.8	188.6
Phys. Sci.	340	12	2.64	3.21	32.9	75.0	16.1	0.0	4.7	0.0	17.0	33.3	8.0	4.5	141.5	175.6

The numbers of A.S. graduates are small, twenty-two compared with 731 A.A. transfer students in the life sciences and twelve compared with 340 A.A. transfers in the physical sciences. Although the A.S. numbers are too small for comparison, Table 3 shows the A.S. graduates in the life sciences and the physical sciences outperformed the A.A. transfers on the G.P.A. measures, and the differences are enough to capture attention. The average credits earned to graduate are much higher for A.S. graduates than for A.A. transfers. The same performance pattern on the G.P.A. measures is found in 1987-88 and 1986-87 data.

Recommendation 3.-- Recommend the Division of Community Colleges continue tracking the progress of associate in science degree graduates who transfer to State University System upper division programs in the life and physical sciences and continue comparing the

progress with the progress of associate in arts degree graduates who transfer to State University System upper division programs in the life and physical sciences. If the associate in science graduates continue to out perform the associate in arts transfers, the Division should conduct a study to determine the cause.

General Education Science

Shortly before his death, I. I. Rabi, a world renowned physicist from Columbia University, was interviewed for television. In that 1985 interview, Dr. Rabi said ". . . in this century, at this time the basic knowledge and patterns of thought come from science . . . The center of culture . . . is science. And (in) the education of young people, science and its values should be central."

For A.A. transfer students who are not science majors, general education science requirements at the community college probably constitute the last science they will receive. What and how much science should be required for the A.A. degree? Neither Florida law nor rule specifies the kind or the amount. The decision is the responsibility of the local boards of trustees. Criteria for Accreditation, published by the Commission on Colleges of the Southern Association of Colleges and Schools (SACS), specifies:

> The [general education] core must include at least one course from each of the following areas: the humanities/fine arts, the social/behavioral sciences, and the natural sciences/mathematics. (1989, p. 18)

What is general education science, science instruction for students who do not plan to major in science? Following reading from an ERIC Clearinghouse for Junior Colleges computer search of the literature and other articles and publications, an article by Carl Sagan of Cornell University, author of Cosmos, the best-selling science book ever published in English, was called to attention. The article, "Why We Need To Understand Science," was in the September 10, 1989, issue of Parade Magazine. Carl Sagan was writing for the general public and a number of his statements are compatible with what was found in the other readings. The following paraphrases some of his points.

Carl Sagan lamented the inability of Americans to distinguish between pseudoscience and real science, and he referred to a recent survey that suggested 94% of Americans were "scientifically illiterate." He said that in our society so dependent on science and technology, it is dangerous to not know about such things as global warming, ozone depletion, toxic and radioactive waste, acid rain. He wondered how we can decide foreign policy when we don't understand the underlying issues about cancer, AIDS, space travel, different missile systems, superconductivity, animal rights, food additives, airline and airport safety, high-resolution TV, addiction, strategic weapons reduction, abortion, supercomputers,

fusion. Carl Sagan wrote:

> Science is much more than a body of knowledge. It is a way of thinking. This is central to its success. Science invites us to let the facts in, even when they don't conform to our preconceptions. It counsels us to carry alternative hypotheses in our heads and see which best match the facts. It urges on us a fine balance between no-holds-barred openness to new ideas, however heretical, and the most rigorous skeptical scrutiny of everything--new ideas and established wisdom. We need wide appreciation of this kind of thinking. It works. It's an essential tool for a democracy in an age of change. Our task is not just to train more scientists but also to deepen public understanding of science.

This consideration of the generally unrealized importance of a scientifically literate population coupled with the consideration in the first section of this chapter of the low level of scientific knowledge in our population demands the active participation of community college science faculty in persistent campaigns to produce general interest in and awareness of science in our lives. Therefore, the following recommendation.

Recommendation 4.-- Recommend that community colleges and community college science faculty actively participate in public education to foster general public awareness, interest, and understanding of science in their communities and the world by participating in science events such as competitions and in public issues deliberations such as those concerning environmental matters; by communicating with the public through print and nonprint media such as popular magazines, newspapers, radio, and television; and by public speaking such as in public school classrooms, club meetings, and public lectures.

Table 4 lists the science credits required by the community colleges. All the colleges exceed the SACS

TABLE 4

Science Requirements for the A.A. Degree
Community Colleges

Community Colleges	Science Requirement	General Ed Requirement	Graduation Requirement	% of Gen Ed Req in Sci	% of Degree Req in Science
Brevard	10	44	64	23%	16%
Broward	7	44	64	16%	11%
Central Florida	9	48	65	19%	14%
Chipola	6	40	64	15%	9%
Daytona Beach	8	46	62	17%	13%
Edison	8	45	64	18%	13%
Florida CCJ	6	36	62	17%	10%
Florida Keys	6	38	62	16%	10%
Gulf Coast	7	45	65	16%	11%
Hillsborough	8	39	62	21%	13%
Indian River	6	42	64	14%	9%
Lake City	10	45	64	22%	16%
Lake-Sumter	6	42	64	14%	9%
Manatee	6	47	68	13%	9%
Miami-Dade	6	38	62	16%	10%
North Florida	6	40	64	15%	9%
Okaloosa-Walton	8	42	64	19%	13%
Palm Beach	6	38	62	16%	10%
Pasco-Hernando	9	40	60	23%	15%
Pensacola	10	43	60	23%	17%
Polk	8	41	60	20%	13%
St. Johns River	8	41	64	20%	13%
St. Petersburg	9	41	64	22%	14%
Santa Fe	8	45	64	18%	13%
Seminole	9	43	64	21%	14%
South Florida	7	44	64	16%	11%
Tallahassee	6	39	62	15%	10%
Valencia	6	36	60	17%	10%

natural science criterion. Eleven colleges require six credits in science. Three colleges require seven credits. Seven colleges require eight credits. Four colleges require nine credits. Three colleges, Lake City Community College, Pensacola Junior College, and Brevard Community College, require ten credits.

Seven community colleges require that just over 20% of the general education credits required for the A.A. degree be in science courses. The percentage that constitutes the mode is 16%. The lowest requirement is 13% at one college.

Science credits as a percentage of the total credits needed for the A.A. degree range from a high of 17% at one college to a low of 9% at five colleges. The percentage that constitutes the mode is 13%.

According to the community college catalogs, the number of courses from which students can select to satisfy general education science requirements ranges from ten at one college to fifty-four at one college, with the other amounts distributed throughout the range. The mean is twenty-six courses. Only five of the colleges require a science laboratory course. The fourteen science courses most commonly offered in the community colleges are:

Anatomy and Physiology
Astronomy
Biology
Botany

Chemistry
Earth Science
Geology
Marine Science
Meteorology
Microbiology
Organic Chemistry
Physical Science
Physics
Zoology

From this information about community college science courses, it is clear that the colleges have different views about what and how much science should be contained in the general education core required of all A.A. degree students. As a part of this review, the college catalogs were examined to learn whether the purposes of the general education core were specified either in the part of each catalog that described the general education core or in other parts.

The purpose of the general education core was stated in seventeen of the twenty-eight catalogs. All but three of the seventeen statements were brief and general statements not expressed in terms of expected results that could be measured. The three exceptions were sufficiently specific to identify a science component, but only one approached being expressed in terms of expected results that could be measured.

Consequently, comparing science requirements with statements of purpose was not conducted. This catalog examination produced the question of reliance on

intuitive leaps from purpose to curriculum.

It is axiomatic that the curriculum of a college carry out the purpose of the college. Carried to the general education core of the A.A. degree program, it follows that the general education curriculum of the college must carry out the purpose of general education within the overall purpose of the college. Further, the general education science requirements within the general education curriculum must carry out the parts of the purpose of general education that can be achieved through science instruction. None of this can be depended upon to occur unless the purpose is stated with sufficient functional specificity to allow application and measurement.

Recommendation 5.-- Recommend that each community college develop a statement of the purpose of the general education core of the associate in arts degree program, and that the statement be expressed discipline by discipline in terms of expected results capable of measurement.

Earlier in this section was reported the finding that only five of the twenty-eight community colleges require a science laboratory course as part of the general education core. The review of the literature, the site hearings, and the science survey all produced widespread support for requiring a science laboratory experience in the general education core. In fact, every reference but one to the science laboratory issue at the

site hearings and in the science survey responses supported requiring a science laboratory experience in the general education core. The one dissention was based on the high cost of such a requirement.

The English and mathematics skills that students are required to demonstrate on the College Level Academic Skills Test before being awarded the associate in arts degree are determined by faculty consensus. Should those general education skills that are rooted in science be decided on a different basis? That is, if faculty judge that a science laboratory experience is necessary as a requirement in the general education core, then should it not be required?

Recommendation 6.-- Recommend that each community college evaluate its general education science requirements against its statement of the purpose of the science component of the general education core; that each community college judge whether the expected results of the science component can be achieved without a science laboratory experience; that each community college design its science requirements accordingly.

Academic Advising

Academic advising is provided either by counselors or by the teaching faculty. When advising is provided by teaching faculty, the faculty often advise those students who will be majoring in the same disciplines as taught by the faculty doing the advising.

When the faculty who attended the site hearings were asked if they knew of any problems associated with the

timeliness and accuracy of advising science majors, no one indicated any problems. All the science faculty who attended were aware of and used the transfer manuals provided by the nine universities. The same question was asked of those who filled out the science survey. No indication of a problem was reported in the survey responses. According to those two measures, students who follow the prerequisites spelled out in the couseling manuals of the universities to which they plan to transfer should encounter no unnecessary transfer problems.

The summative review of the associate in arts degree program, which was being conducted as this report was being written, also used a questionnaire that contained an item on academic advising. Eleven community colleges judged their academic advising to be very good. Fourteen judged their academic advising to be good. Three judged it to be satisfactory.

All these judgments about the adequacy of academic advising came from faculty and administrators. When community college transfer students were interviewed during the science review, 32% said their community college advisors were not familiar with the prerequisites for their upper division programs. Eighty-two percent said they had planned their courses without the help of their advisors. They judged the quality of community

college advising to be satisfactory, but advised caution.

Table 2 shows that it takes A.A. transfer students 10.1 credits more than native students to earn the baccalaureate in the life sciences and 3.7 credits more in the physical sciences. The average difference for all the SUS programs is 4.7 credits more for A.A. transfers than for natives. These differences and the differences in the opinions of community college faculty, administrators, and graduates about academic advising are sufficient for the community colleges to investigate further the adequacy of their academic advising.

The statewide Student On-line Advisement and Articulation System (SOLAR) is operating in six disciplines with others to be added as soon as possible. One of the six disciplines is biology. SOLAR provides students with access to advisement information not readily available before.

Faculty Development

There were 402 full-time science faculty and 286 part-time science faculty in the community colleges in 1988. Their highest earned degree distribution is shown in Table 5.

Rule 6A-14.029, F.A.C., requires each community college to spend an amount equal to at least 2% of the previous year's allocation from the Community College

Program Fund on staff and program development (SPD) activities. One of the questions on the science survey asked for a rating of the expenditure of SPD funds in terms of science faculty and science program development. Four (15%) rated the expenditure excellent, seventeen (66%) rated it good, and five (19%) rated it fair. No one rated the expenditure poor. When the same question was raised at the site hearings, the science faculty in attendance gave the same responses as were given on the science survey.

TABLE 5

Science Faculty by Highest Earned Degree
Community Colleges, 1988

Degree Status	Full-Time	Part-Time
Doctorate	38.8%	19.4%
Masters + 30 Credits	31.6%	15.3%
Masters	28.6%	50.0%
Baccalaureate	1.0%	13.3%
Less Than Baccalaureate	0.0%	2.0%

Discussions at the five site hearings revealed that the use of SPD funds by science instructors to keep abreast of changes in their disciplines varied from college to college. Some faculty felt that attendance at professional meetings, formal course work, or going to

specialized workshops were essential to staying abreast in their field. Others felt that keeping current in their reading resulted in awareness of developments in their fields. Others said that they simply did the best they could with course loads that prevented them from spending time away from the classroom. The latter view generally was expressed by science faculty at small colleges where two or three people comprised the entire science department and there was no pool of part-time faculty available to free the full-time faculty for time away from campus.

A potential help for the in-service education needs of place-bound science instructors is the Florida Satellite Network. The system is available in each community college district. The cost is not prohibitive with a $100 receiving fee for thirty viewers, broadcast costs of $300 to $500 per hour, and production costs that run from $200 to $500 depending on the nature of the program. The system might be used effectively to help keep faculty current on recent research findings that need to be part of the curriculum, and to disseminate new ideas and methods for improving instruction in the sciences.

Recommendation 7.-- Recommend that each community college involve its faculty in an investigation of the Florida Satellite Network and how it can be used for faculty and program development.

Science Faculty Interaction

According to the responses to the science survey, most community college science faculty do not engage in regular meetings with their colleagues in the state universities or in the local high schools. When asked if regular meetings are held with university science faculty, twenty (74%) of the twenty-seven responses were that no regular meetings are held. Table 6 shows the number of articulation meetings reported as planned and conducted between science faculties of the twenty-eight community colleges, the nine public universities, and the private colleges.

TABLE 6

A.A. Program Review
Level II Articulation Meetings

	1987-88 Meetings		1988-89 Meetings		1989-90 Meetings	
	Planned	Conducted	Planned	Conducted	Planned	Conducted
Life Sci.	13	16	15	22	15	
Phys. Sci.	15	20	14	23	14	

When asked if regular meetings are held with local high school science faculty, nineteen (68%) of the twenty-eight responses were that no regular meetings are held. Without the regular exchange of information between community college science faculty and high school

science faculty, it is easy to understand why only 15% of the responses to the science survey indicated awareness of the high school science curriculum frameworks, which are course by course descriptions of the science competencies taught in high schools.

Recommendation 8.-- Recommend that community colleges schedule, on at least an annual basis, formal meetings between their science faculty, district high school science faculty, and university science faculty to exchange information about the teaching of science.

Minority Science Faculty

A recently published report of the Minority Graduate Education Project, Increasing Minority Faculty: An Elusive Goal, made the following observation concerning minority representation in two-year and four-year colleges.

> Minority underrepresentation in academe has been attributed to three factors. First, among Asian Americans and Hispanics, it is associated with slowdown in doctoral production, and within the Black community, to their real and relative declines in the doctorate pool. Second, among new minority Ph.D.'s, the proportion choosing careers in academe is dwindling. However, the third aspect of the outflow is the lack of minority faculty retention in academe. Thus, the problem of underrepresentation is one of supply, flow into and through the academic pipeline, and minority faculty retention.

The Minority Graduate Education Project report reinforced a recommendation concerning the recruitment and retention of minority faculty first voiced in Black Issues in Higher Education, 1987.

Some programs boasting successful recruitment of minority faculty place considerable emphasis on affirmative action programs that aggressively recruit minorities and that go beyond mere equal opportunity employment practices and policies. To do less will keep underrepresented groups in their same relative positions in academe, particularly in a tight labor market. Affirmative action strategies to increase minority participation should include incentives, such as, additional tenure-track positions on a competitive basis for departments that are willing and able to attract minority faculty candidates, taking into consideration academic field, program needs, and student enrollment.

Table 7 information is taken from the responses to the science survey. The number of full-time, minority science faculty in the community colleges in the fall of 1988 is displayed according to the courses they taught. The forty full-time, minority science faculty comprised 10% of the 402 full-time science faculty that semester.

Table 7

Full-Time Minority Science Faculty
Community Colleges
1988

	Black	Hispanic	Asian
Anatomy/Physiology	1		
Biology	15	1	3
Chemistry	2	5	2
Geology		2	
Physical Science			1
Physics		4	4
Totals	18	12	10

Real effort is necessary to recruit and retain minority faculty in the sciences. Among the clearinghouse or information exchange resources used by the community colleges are the Affirmative Action Register and the Position Vacancies list of the State Board of Community Colleges. A suggestion before the Equal Access and Equal Opportunity Committee of the State Board of Community Colleges is the production of a catalog of the minority faculty recruitment practices of the community colleges. Three examples of aggressive general minority recruitment are the programs at Miami-Dade Community College, Pensacola Junior College, and Valencia Community College.

Miami-Dade Community College decided that 50% of all new hires in the personnel classifications of executive-administrative, faculty, and professional non-faculty would be minorities. A recruiting program started in 1987 by establishing a vita bank. Ads were placed in the Chronicle of Higher Education and aimed at minority applicants. The ads described Miami-Dade Community College and its educational goals. Readers were encouraged to submit vita, and 150 were received. As a position opens, applicable vita from the vita bank are given to those who make the employment decision. Another element of the Miami-Dade recruiting program is the establishment of a national network of colleges and

universities to put Miami-Dade Community College in contact with prospective minority employees.

Pensacola Junior College established a committee of citizens to make recommendations on minority issues. The committee recommended increased efforts to recruit minority faculty. In response, Pensacola Junior College established a traveling recruiting team to establish and maintain contact with institutions that produce potential minority faculty, including visits to those institutions and their graduates.

Valencia Community College recruits students from historically black institutions, but also actively recruits from other institutions that are identified as doing outstanding jobs in educating minorities. Valencia Community College decided that when an employment category is below the equity goal set for it, that category will be targeted for more intensive recruitment activities to locate minority applicants.

Recommendation 9.-- Recommend that community colleges reexamine their EA/EO recruitment procedures and make necessary adjustments to ensure the employment of equitable representations of minority science faculty.

Supervision of Part-Time Instructors

Problems concerning the supervision of part-time science instructors were expressed at each of the five site hearings. One of the problems was the difficulty of

meeting with part-time instructors when students need extra help. Science faculty members at the site hearings told of instances of part-time science instructors arriving on campus just prior to the start of class and leaving immediately after class. Although the part-time instructors had been told to hold office hours for the convenience of the students, the requirement to keep office hours was not enforced, due to little supervision during evening class hours. The situation is complicated further by the fact that the majority of evening students are part-time students, many of whom need extra help to master the science skills being taught.

The lack of evening supervision of part-time science instructors was given as the reason one public school science supervisor discourages teachers under his supervision from taking evening science courses taught by part-time instructors at the local community college. Many of the faculty at the site hearings said that part-time instructors often do not receive adequate support services. Part-time science instructors where described at one site hearing as briefcase instructors, where the briefcase serves as office, file folder, and filing cabinet.

These problems led St. Petersburg Junior College to revise its policy concerning the supervision of

part-time instructors in the fall of 1988. Daytona Beach Community College conducted a comprehensive review of its policies concerning part-time faculty, and implemented policy and procedural changes.

Recommendation 10.-- Recommend that colleges that have not recently done so, review their policies and procedures concerning supervision of part-time science instructors to assure that students with part-time science instructors receive the same quality of instruction as students with full-time science instructors.

Equipment

The Advisory Committee was relied upon quite heavily in the development of the survey instrument, especially for questionnaire items such as those dealing with equipment. Responses to the survey reported 297 computers directly controlled by the science departments. However, computer use was reported as seldom to occasional. The quality and adequacy of buildings, furniture, and equipment other than computers were reported as generally adequate with a few excellent. Only three categories out of twenty drew many ratings of inadequate: laboratory furniture (twelve), laboratory ventilation and hoods (fourteen), analytical chemistry equipment (eleven). Another questionnaire item asked for the number of each of eighteen specific pieces of equipment; for example, 221 electronic balances were reported. However, with the exception of general

recommendations of the American Chemical Society, no equipment standards were found for any of the science disciplines.

Several of the community colleges employ full-time or part-time equipment maintenance specialists. At the site hearings, the idea was offered that colleges not able to hire equipment maintenance specialists independently might join in consortium arrangements to do so. Another suggestion was that science instructional equipment replacement schedules be developed and followed by the colleges. The logic behind the suggestion was that the planned spacing of replacement costs is more easily budgeted than irregular, large amounts.

The findings do not evidence a systemwide equipment need. However, fourteen community colleges reporting inadequate laboratory ventilation and hoods in their responses to the survey raises the question of safety and prompts a recommendation. The problem with equipment maintenarce, especially at the small colleges, as brought out in the responses to the survey and at the site hearings prompts a recommendation.

Recommendation 11.-- Recommend that community colleges with inadequate science laboratory ventilation and hoods incorporate that determination in their planning for facilities construction, remodeling, and renovation.

Recommendation 12.-- Recommend that community colleges not able to hire science equipment maintenance

specialists investigate the feasibility of joint arrangements with neighboring community colleges to obtain such services.

The General Education Science section of this report told of the pronounced preference in the literature and of science faculty for a required science laboratory course in the general education core. For a community college to establish such a requirement, it must have laboratory facilities and equipment. Computers can be used to simulate laboratory experiments, a particularly attractive alternative in the absence of science laboratory requirements in the general education core. Some science faculty report a growing movement to expand the use of computers in science instruction. In view of these conditions, generalized science equipment and facilities needs could develop rapidly, which bears watching by the Division of Community Colleges.

SUMMARY

Understanding the relationship of science and life is essential for educated people. This program review examined the teaching of science in the community colleges and produced recommendations intended to result in improvement in the understanding of science by both science and nonscience majors in Florida's community colleges.

The review dealt with the preparedness of entering freshmen, the performance of community college science majors at the junior and senior level, the nature of the science experience for nonscience majors, the acceptance of community college science credit toward the baccalaureate, the quality of academic advising for community college science majors, the opportunity for improving the knowledge and skills of community college science faculty, the degree to which there are professional exchanges between community college faculty and their colleagues in the high schools and universities, the efforts to increase the number of minority science faculty, the problems associated with the supervision of part-time science faculty, and the science instructional equipment need.

The findings resulted in twelve recommendations.

Two recommendations deal with articulation, four with curriculum and instruction, four with faculty, and two with equipment and facilities.

RECOMMENDATIONS

These recommendations first appear in the chapter on findings, along with the information that supports them. They are repeated here for easy reference.

Recommendation 1.-- Recommend the community colleges search out and grasp opportunities to be supporting partners of the public schools for the improvement of math and science teaching and learning in the public schools. One of the many elements in this important effort should be articulation meetings between high school and community college math and science faculty, especially concerning the math and science skills expected of beginning college students and the math and science skills demonstrated by beginning college students.

Recommendation 2.-- Recommend a thorough study of the high school, community college, and university transcripts of community college associate in arts degree graduates and State University System native students enrolled in life science and physical science upper division programs in the SUS to compare the mathematics and science courses in their backgrounds and to compare upper division performance.

Recommendation 3.-- Recommend the Division of

Community Colleges continue tracking the progress of associate in science degree graduates who transfer to State University System upper division programs in the life and physical sciences and continue comparing the progress with the progress of associate in arts degree graduates who transfer to State University System upper division programs in the life and physical sciences. If the associate in science graduates continue to out perform the associate in arts transfers, the Division should conduct a study to determine the cause.

Recommendation 4.-- Recommend that community colleges and community college science faculty actively participate in public education to foster general public awareness, interest, and understanding of science in their communities and the world by participating in science events such as competitions and in public issues deliberations such as those concerning environmental matters; by communicating with the public through print and nonprint media such as popular magazines, newspapers, radio, and television; and by public speaking such as in public school classrooms, club meetings, and public lectures.

Recommendation 5.-- Recommend that each community college develop a statement of the purpose of the general education core of the associate in arts degree program, and that the statement be expressed discipline by

discipline in terms of expected results capable of measurement.

Recommendation 6.-- Recommend that each community college evaluate its general education science requirements against its statement of the purpose of the science component of the general education core; that each community college judge whether the expected results of the science component can be achieved without a science laboratory experience; that each community college design its science requirements accordingly.

Recommendation 7.-- Recommend that each community college involve its faculty in an investigation of the Florida Satellite Network and how it can be used for faculty and program development.

Recommendation 8.-- Recommend that community colleges schedule, on at least an annual basis, formal meetings between their science faculty, district high school science faculty, and university science faculty to exchange information about the teaching of science.

Recommendation 9.-- Recommend that community colleges reexamine their EA/EO recruitment procedures and make necessary adjustments to ensure the employment of equitable representations of minority science faculty.

Recommendation 10.-- Recommend that colleges that have not recently done so, review their policies and procedures concerning supervision of part-time science

instructors to assure that students with part-time science instructors receive the same quality of instruction as students with full-time science instructors.

Recommendation 11.-- Recommend that community colleges with inadequate science laboratory ventilation and hoods incorporate that determination in their planning for facilities construction, remodeling, and renovation.

Recommendation 12.-- Recommend that community colleges not able to hire science equipment maintenance specialists investigate the feasibility of joint arrangements with neighboring community colleges to obtain such services.

APPENDIX 1

Attendance at Site Hearings

Florida Community College at Jacksonville
April 18, 1988

Clare C. Barley
Florida Community College at Jacksonville

Patrick M. Commons
Florida Community College at Jacksonville

Tom Fico
North Florida Junior College

Dennis P. Gallon
Florida Community College at Jacksonville

Matilda Girardeau
Florida Community College at Jacksonville

Martha M. Green
Florida Department of Education

Mary Holton
Central Florida Community College

Kathy Kilcreau
Central Florida Community College

Jean Klein
Santa Fe Community College

John Kolesay
Florida Community College at Jacksonville

Ker-Fong Lee
Florida Community College at Jacksonville

Gabriel J. Milanese
Broward Community College

John Mullins
Florida Community College at Jacksonville

Bobbie Murray
Florida Community College at Jacksonville

Ed Napier
Florida Community College at Jacksonville

Ram G. Singh
Florida Community College at Jacksonville

Ann Springer
Hillsborough Community College

Bill Vockeu
Florida Community College at Jacksonville

Valencia Community College
March 1, 1988

Karen Belcher
Lake City Community College

Jack Benefield
Valencia Community College

Allan Bonamy
Daytona Beach Community College

Edmund Cameron
Lake-Sumter Community College

Genevieve Cook
Valencia Community College

Howard Crawford
South Florida Community College

Alexander K. Dickison
Seminole Community College

Bill Ferron
Polk Community College

Elizabeth Gibson
St. Johns River Community College

Anita Harrow
Valencia Community College

Judith M. Jones
Valencia Community College

Ken King
Seminole Community College

Dennis Lehn
Indian River Community College

Jane MacDonald
Miami-Dade Community College

Dallas W. Maddron
Orange County Schools

Bill McCord
Valencia Community College

James Newton
Edison Community College

Ernest Niblack
Valencia Community College

Doris Marie Presley
Indian River Community College

Ernest L. Rhamstine
Valencia Community College

Charlie Jean Satter
Valencia Community College

Bettie Spratt
Seminole County Schools

Sue Taggart
Indian River Community College

Robert Wall
Lake-Sumter Community College

Dave Wilson
Valencia Community College

<u>Pensacola Junior College</u>
<u>March 11, 1988</u>

W. Y. Bennett
Pensacola Junior College

R. Birdwhistell
University of West Florida

Roy Bundy
Okaloosa-Walton Community College

Dona K. Cotten
Pensacola Junior College

Ron Head
Okaloosa-Walton Community College

Cordell Henry
Gulf Coast Community College

Tom King
St. Petersburg Junior College

Mike Palmer
Pensacola Junior College

Dennis Poole
Gulf Coast Community College

John Ryan
Tallahassee Community College

Mary E. Spears
Pensacola Junior College

Ed Stout
Pensacola Junior College

St. Petersburg Junior College
March 16, 1988

Anne Barber
Manatee Community College

Barbara Dinsmore
Manatee Community College

Tom King
St. Petersburg Junior College

Rosemary M. Mosley
University of South Florida

Robert W. Orlopp
Pinellas County Schools

John P. Rimsa
St. Petersburg Junior College

Charles Roberts
St. Petersburg Junior College

Jeanne Robinson
Seminole Community College

Le Roy Scott
St. Petersburg Junior College

Edwin Stout
Pensacola Junior College

Starr C. Weihe
St. Petersburg Junior College

John L. Wilson
Manatee Community College

The attendance list for the hearing in Fort Lauderdale is not available.

APPENDIX 2

Survey
Level III Program Review of the Science
Component of the A.A. Degree

1. Name of college _____

2. Name, title, campus, and phone number of person completing the survey (The survey should represent the entire college)

_____

_____

3. What are the Associate in Arts general education requirements in science at this college? (Please include labs if required)

_____

_____

_____

_____

_____

4. Number of full-time science instructors by discipline by degree. (Unduplicated headcount. In the case of instructors teaching in more than one field, list the fields together, i.e.; Biology/Botany, Fall session only)

	Full-Time Instructors					Part-Time Instructors				
Field	Doctorate	MA +30	MA	BA	Male Female	Doctorate	MA +30	MA	BA	Male Female
Biology										
Geology										
Chemistry										
Zoology										
Physics										
_____										
_____										
_____										

5. Please list minority instructors full or part-time by discipline. (For example, Black 1 biology full-time, Black 1 chemistry part-time.)

Black _____

_____

_____

Hispanic _____

_____

_____

Asian _____

_____

_____

American Indian _____

_____

_____

Alien _____

_____

_____

6. What is considered the minimum full-time teaching load for science instructors at your institution? (Contact hours)

_____

_____

_____

7. How does your college compute lab hours when computing minimum full-time credit hour loads for science instructors? _____

_____

_____

_____

8. After what point is it considered to be overload teaching?

_____

_____

_____

_____

9. Approximately what percent of the science faculty teach an overload on a regular basis? _____% every semester
_____% once every two semesters _____% once in an academic year.

10. Do you employ student assistants? _____ Yes _____ No

11. What would you estimate as the percentage of the science instructors at your college who are members of a science discipline professional organizations? _____%
What percent of those who belong to discipline professional organizations are active in the organization; i.e. attend local, regional, national meetings, hold office, are published in professional journals? _____% For what reasons are members of discipline professional organizations inactive in the organizations?

-Lack of college funding to attend meetings? ___Yes ___ No

-See no relevancy between teaching responsibilities and activities of professional organization? _____Yes ____ No

-Apathy _____ Yes _____ No

-Other (Specify) _____

_____

_____

12. How would you rate the expenditure of staff and program development funds in terms of the science faculty and science program development?

_____ Excellent _____ Good _____ Fair _____ Poor _____

13. How well is the science faculty at your college informed about the curriculum frameworks developed by the secondary school teachers in science? _____ Well informed _____ Somewhat _____ Not at all

14. Please indicate the impact that the high school curriculum frameworks have had on the college's science curriculum.
_____ Some _____ None
If some, please describe. _____

_____

_____

15. Are there regular meetings between the college's science faculty and the area high schools' science faculty? _____ Yes _____ No

If yes, how often? _____

_____

_____

16. Are there regular meetings between your science faculty and the science faculty of the university where most of your students transfer? ____Yes ____ No
If yes, how often? _____

What is the nature of these meetings? _____

_____

_____

17. Please describe articulation problems between the area high schools and the colleges in the area of the sciences.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

18. Please describe any particular articulation problem between the colleges and the universities in the area of science.

_____

_____

_____

_____

_____

_____

_____

19. Is placement testing used for any science course?
_____yes _____no If yes, what type of placement tests are used? _____

_____

_____

_____

20. How are science students tested?

Individual instructor exams _____
Department Exams _____

21. Please assess the size of the science library collection.

_____ excellent _____ adequate
_____ inadequate

22. Please assess the size of the science film/TV tape collection.

_____excellent _____adequate
_____inadequate

Please assess the quality of the science film/TV tape collection.

_____excellent _____adequate_____inadequate

23. Please assess the size and quality of the specimen collections in the following areas.

	Excellent	Adequate	Inadequate
Biology			
Zoology			
Anatomy			
Physiology			
Chemistry			
Physics			
Geology			
Astronomy			
Oceanography			
Meteorology			
Others			
_____			
_____			
_____			
_____			
_____			
_____			

24. How many computers are directly controlled by the science department? _____
Please assess the science software collection.
_____ excellent _____ adequate
_____ inadequate

25. To what extent are computers used for?

	Routinely	Occasionally	Seldom	Never
C.A.I				
Computation				
Lab experiments				
Simulations				
Professional Production				
Student Production				
Science Application				

26. Assess the quality and adequacy of the following items

	Excellent	Adequate	Inadequate
a. Buildings			
b. Laboratory furniture			
c. Laboratory ventilation and hoods			
d. Equipment for teaching mechanics			

e. Equipment for teaching optics _____ _____ _____

f. Equipment for teaching electricity and magnetism _____ _____ _____

g. Equipment for teaching sound _____ _____ _____

h. Equipment for teaching heat _____ _____ _____

i. Compound microscopes _____ _____ _____

j. Dissecting microscopes _____ _____ _____

k. Balances _____ _____ _____

l. Explosion proof refrigerators _____ _____ _____

m. Incubators _____ _____ _____

n. Drying Ovens _____ _____ _____

o. Chemical storage cabinets and areas _____ _____ _____

p. Skeletons _____ _____ _____

q. Torso models _____ _____ _____

r. Equipment for teaching general chemistry _____ _____ _____

s. Equipment for teaching organic chemistry _____ _____ _____

t. Equipment for teaching analytical chemistry _____ _____ _____

27. How many of the following do you have in the science department

Autoclave	_____
Respirometer	_____
Air track	_____
Air table	_____
Lasers	_____
Geiger counter	_____
Scintillation counter	_____
Analytical balance	_____
Electronic balance	_____
Spectrometer 20" type spectrometer	_____
UV-VIS spectrometer	_____
IR spectrometer	_____
NMR spectrometer	_____
Mass spectrometer	_____
Gas chromatography	_____
Liquid chromatography	_____
Atomic absorption	_____

28. Is there a college, campus or department health and safety plan?
_____ Yes _____ No

29. Please describe the college, campus or department procedures for storage, handling, and disposal of hazardous chemicals.

A. Storage _____

_____

B. Handling _____

_____

C. Disposal _____

_____

30. Please describe what appears to you to be the single greatest barrier to producing community college transfer students with sound groundings in science.

_____

_____

_____

_____

_____

_____

31. A central thread to the program review of the science component in the A.A. program is the question concerning what a non-science major should know about science when he leaves the community college. Being a non-science major, there is little chance that the student will ever take a formal course in science again. What formal instruction the student gets in the community college is the last formal instruction they will ever get. When this question has been put to the A.A. science review advisory committee, the responses have ranged from a rigorous discipline approach, lectures with labs, to an interdisciplinary broadly based survey course. Your thoughts please.

A final note. Please be assured that before the review report is presented to the State Board of Community Colleges there will be ample opportunity to examine and comment on draft copies. The final report and Board action will be widely distributed throughout the community college system, the Division of Public Schools, and the State University System. Please return this form to David L. Ehlert, Division of Community Colleges, Knott Building, Tallahassee, Florida 32399 by March 29, 1989.

State of Florida
Department of Education
Tallahassee, Florida
Betty Castor, Commissioner
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